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DEONTOSTOMA COPTOCHILUS N. SP., A MARINE NEMATODE (LEPTOSOMATIDAE) FROM THE FOOT CAVITY OF THE DEEP-SEA ANEMONE *ACTINAUGE LONGICORNIS* (VERRILL, 1882)

W. Duane Hope

Abstract.—Hope, W. D., Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.—*Deontostoma coptochilus*, a new species of marine nematode (Leptosomatidae), is described. The specimens upon which the description is based were extracted from sediment within the foot cavity of the deep-sea anemone *Actinauge longicornis* (Verrill, 1882) collected at 1,000 m depth off the coast of Uruguay. This is a new depth record for a species of this genus. The associations between various species of *Deontostoma* and other marine organisms is discussed.

Numerous specimens of a new species of *Deontostoma* have been discovered in the foot cavity of the deep-sea anemone, *Actinauge longicornis* (Verrill, 1882), collected during cruises of the German research vessel *Walter Herwig*. The sea anemone was the subject of an earlier investigation by Dr. K. Riemann-Zürneck (1973) and the nematodes were made available for the present study through the courtesy of Dr. Franz Riemann of the Institut für Meeresforschung in Bremerhaven, West Germany.

Materials and Methods

All specimens were fixed in 6–8% formalin, then preserved in 80% ethanol. Subsequently, each specimen was processed by the slow method into anhydrous glycerine and mounted on glass slides for preliminary study. Ten males (NMNH Nos. 53542 thru 53551), and 11 females (NMNH Nos. 53567 thru 53577), including the holotype and allotype, were selected for the measurements listed in Table 1. Two males (NMNH Nos. 53542 and 53564) have been decapitated for the purpose of preparing face views for light microscopy, and their spicula and gubernacula, as well as the ventromedian supplement of NMNH No. 53564, were excised and permanently mounted for photomicrography. The right spiculum of a third male (NMNH No. 53565) was also excised and mounted on a slide, while the head was prepared for SEM. The heads and tails of 2 additional males (NMNH Nos. 53558 and 53566) were also prepared for SEM. The procedure for SEM preparation has been described elsewhere (Hope, 1974).

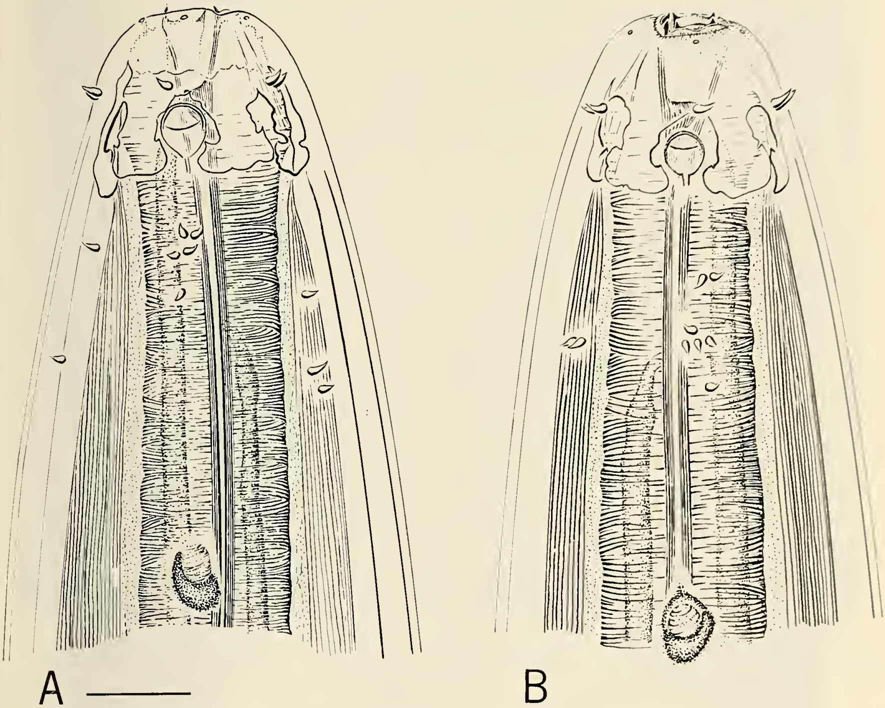


Fig. 1. Head and neck regions of the holotype (A) and allotype (B) of *Deontostoma coptochilus* in lateral view. Scale applies to A and B and equals 20 μm.

Deontostoma coptochilus, new species
Figs. 1–8

Specimens studied.—25♂♂, 37♀♀; 18 *θθ*

Description.—Body small for *Deontostoma* (Table 1), gradually tapered anteriorly and posteriorly from mid-body region; head bluntly rounded (Figs. 1 & 2). Tail conical with blunt terminus (Figs. 4 & 5). Cuticle smooth. Head with 6 labial papillae and 10 cephalic setae. Short lateral, subdorsal, and subventral cervical setae between cephalic suture and region of ocelli. Setae posterior to nerve ring, in 1 subdorsal, 2 sublateral and 1 subventral row on each side of body.

Cephalic capsule (Fig. 1) without prominent anterior lobes or tropis and with usual 6 posterior lobes. Each posterior lobe broadened at its posterior end with or without small anteriorly directed tines. Posterior end of each lobe rounded to truncate with but few shallow notches or incisions. Intralobar lacunae absent. Anterior margin of cephalic capsule with or

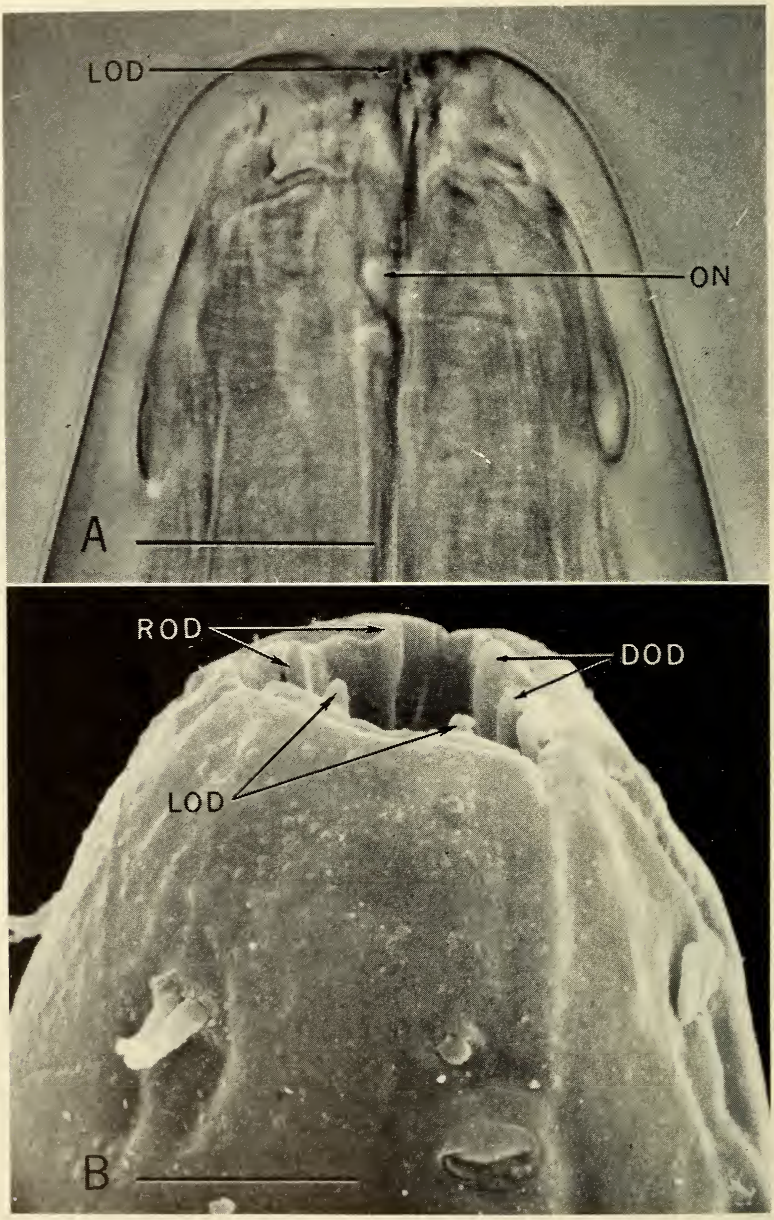


Fig. 2. Head region of *Deontostoma coptochilus* in lateral view. A, Photomicrograph showing the dorsal odontium (LOD) of the left subventral mandibular ridge and dorsal onchium (ON). Scale is 20 μm; B, SEM picture showing odontia on dorsal (DOD) and right (ROD) and left (LOD) subventral mandibular ridges. Scale is 10 μm.

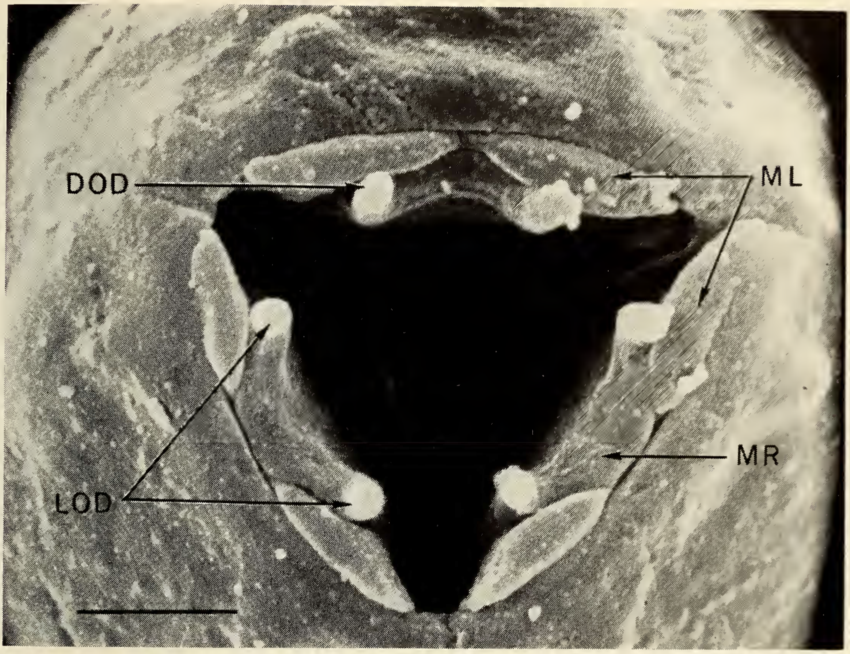


Fig. 3. SEM face view of *Deontostoma coptochilus* showing microlabia (ML) mandibular ridges (MR) and dorsal (DOD) and left subventral (LOD) odontia. The dorsal onchium is barely visible in the stoma. Scale is 5μm.

without adjacent band of intracuticular reticulation. Amphid circular to oval.

Stoma (Fig. 3) triangular with orifice enclosed by 1 dorsal and 2 subventral microlabia. Dorsal microlabium nearly divided by mandibular ridge bearing paired odontia; each subventral microlabium completely divided by mandibular ridge; each subventral mandibular ridge bearing paired odontia. All 6 odontia anteriorly directed and bluntly conical. In single specimen measured, interval between tips of dorsal odontia 5.7 μm; and 6.7 and 6.9 μm between tips of each member of right and left subventral pairs respectively. Dorsal wall of stoma with single large onchium (Figs. 1A, 1B and 2A); tip of onchium at level of cephalic setae.

Esophagus conical and with paired ocelli; each ocellus comprised of spherical lenslike structure and reddish-brown pigment spot. Dorsal esophageal gland orifice approximately midway between posterior margin of cephalic capsule and ocelli (Table 1).

Tail terminus with caudal gland pore. Caudal glands outstretched and extending anterior to rectum (Fig. 4A).

Males.—As in general description. Subventral supplements (Fig. 5B) in

Table 1. Morphometric data for *Deontostoma coptochilus*.

Character	Sex	Number of variates	Range	Mean	Standard deviation	Standard error
a	♂♂ & ♀♀	21	36.9–58.1	46.06	5.43	1.18
b	♂♂ & ♀♀	21	6.00–8.32	6.88	0.49	0.10
c	♂♂ & ♀♀	20	85.6–166.1	115.17	20.00	4.47
Total length (mm)	♂♂ & ♀♀	21	9.59–13.07	11.29	0.96	0.21
Dist. to amphid*	♂♂ & ♀♀	21	12.7–20.9	17.13	2.56	0.56
Amphid length	♂♂ & ♀♀	21	9.58–18.2	12.77	2.45	0.53
Amphid width	♂♂ & ♀♀	21	8.75–17.2	12.25	2.61	0.57
Head width	♂♂ & ♀♀	21	35.4–48.0	41.86	3.07	0.67
Cephalic capsule-length*	♂♂ & ♀♀	21	29.0–44.5	34.63	4.18	0.91
Cephalic setae	♂♂ & ♀♀	44	5.0–10.0	7.12	1.41	0.21
Distance to DEGO (absolute)†	♂♂ & ♀♀	20	44.5–80.0	61.83	8.94	1.99
Distance to DEGO (% of dist. to ocellus)	♂♂ & ♀♀	20	39.0–68.1	54.59	6.76	1.51
Distance to ocellus*	♂♂ & ♀♀	20	98.0–132.7	113.39	9.10	1.98
Length of esophagus (mm)*	♂♂ & ♀♀	21	1.42–1.93	1.66	0.13	0.02
Body width at base esophagus	♂♂ & ♀♀	21	185–226	205.2	11.1	2.4
Midbody width	♂♂ & ♀♀	21	215.5–273.9	246.7	17.6	3.8
Distance to vulva (absolute; mm)	♀♀	11	5.28–7.16	6.20	0.60	0.18
Distance to vulva (% of body length)	♀♀	11	48.2–60.0	54.43	3.56	1.07
Ova length		13	198.60–363.00	284.63	53.68	14.88
Ova width		13	102.70–308.00	173.64	68.52	19.00
Spicula length (arc)	♂♂	10	175.5–193.8	188.81	6.42	2.03
Gubernaculum length	♂♂	10	110.6–132.6	120.07	6.43	2.03
Anal vent-vms‡	♂♂	10	81.6–104.9	96.55	6.93	2.19
Number of preanal setae-right	♂♂	10	15–24	19.4	2.87	0.90
Number of preanal setae-left	♂♂	9	16–25	19.88	3.28	1.09
Preanal setae-length	♂♂	64	11–23	17.01	3.37	0.42
Mammate svs-right	♂♂	10	2–4	3.20	0.60	0.18
Mammate svs-left	♂♂	10	3–4	3.60	0.48	0.15
Cloacal body diameter	♂♂	10	118.0–142.8	131.19	7.70	2.43
Anal body diameter	♀♀	10	100–116	106.20	3.00	1.56
Tail length	♂♂ & ♀♀	21	75.4–118.0	99.71	12.08	2.70

All absolute measurements in μm unless indicated otherwise.
* Measured from anterior margin of head.
† Distance from anterior margin of head to dorsal esophageal gland orifice.
‡ Distance from anal vent to ventromedian supplement.

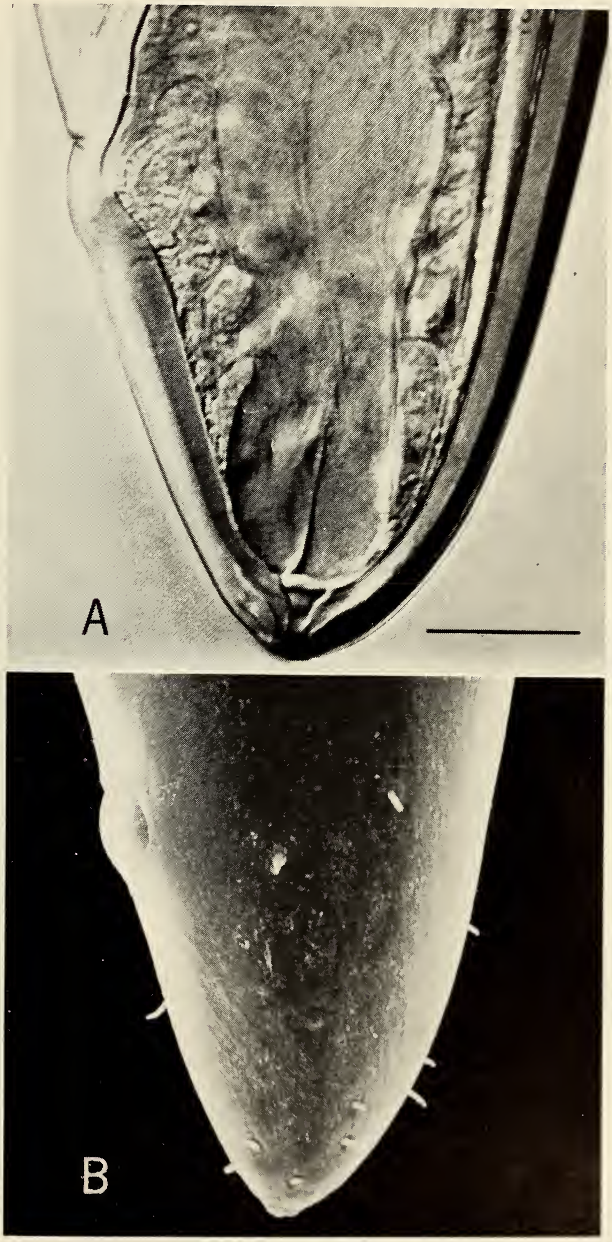
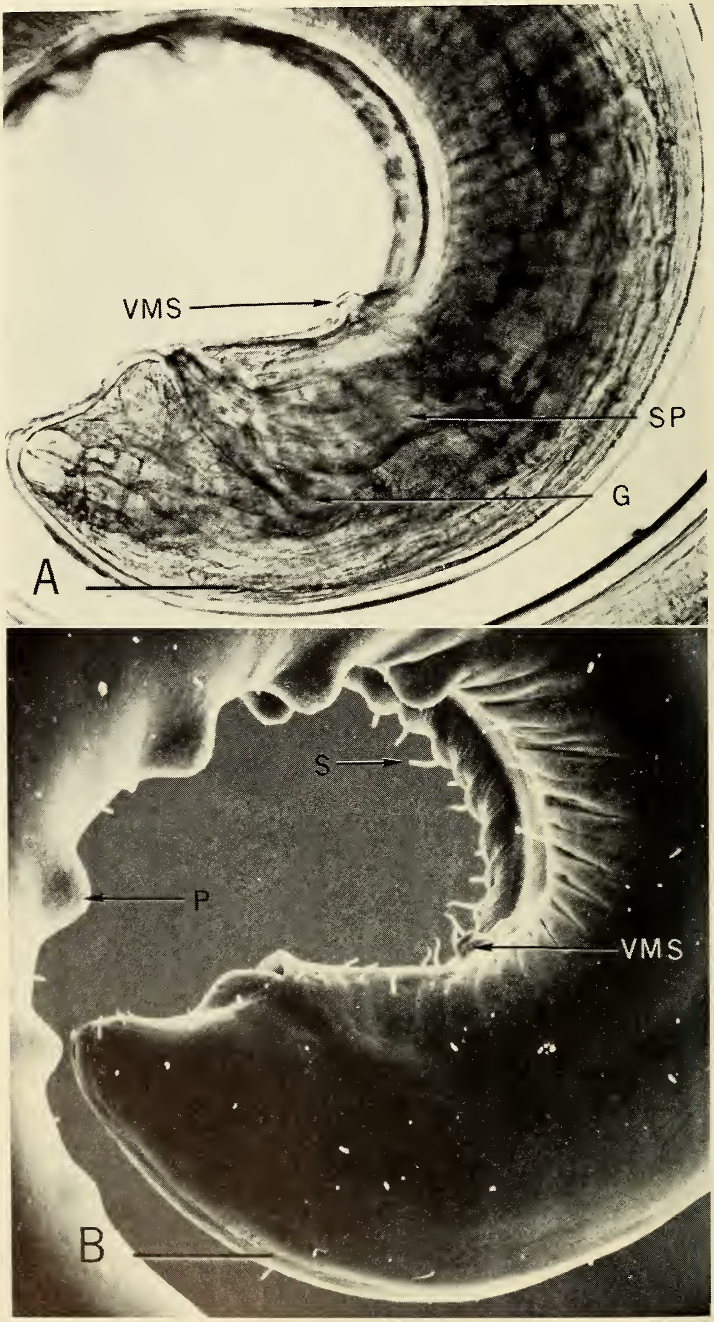


Fig. 4. Female tails of *Deontostoma coptochilus* in lateral view with photomicrography (A) and scanning electronmicrography (B). Scale applies to A and B and equals 30 μm.


VMS
SP
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one longitudinal series on each side of body extending anteriorly from just posterior to cloaca. Each series comprised of setae typically located on top of low transverse folds of cuticle. Setae at anterior end of series interspersed with papillae on top of prominent, mammate evaginations of cuticle and underlying hypodermis. Posteriormost 3 or 4 evaginations very prominent; anterior to this, evaginations distinctly smaller. Cuticle of evaginations without closely packed, internal rodlike structures as occur in *Deontostoma californicum* Steiner & Albin, 1933.

Ventromedian supplement (Figs. 5A, B; 6A, B; 7A–C) a raised oval disc a short distance (Table 1) anterior from cloacal vent. Disc bears depression slightly posterior from its center with ridge extending anteriorly. Floor of depression raised, to form stout, flat-topped peduncle with central pore. Disc circumscribed by oval field of minute striae on surface of cuticle (Fig. 6B) and flanked anteriorly and posteriorly by zones of intracuticular reticulations; anterior zone approximately circular in shape, posterior zone lenticular (Fig. 6B, C).

Spicula (Fig. 8A) scimitar-shaped with angular bend near distal end; calomus short in relation to lamina. Lamina comprised of 3 ribs; ventral rib wide between calomus and distal third of lamina; dorsal lamina widest distal to angular bend. Calomus with lateral, anteroventrally directed process. Capitulum not enlarged or otherwise set off from calomus. Gubernaculum (Fig. 8B) duplicate; corpus of each half consisting of parallel bars fused at each end. Proximal end broad for muscle attachment; distal end with several distinct transverse striations. Corpus without a crus.

Male reproductive system diorchic; testes opposed.

Females.—As in general description. Reproductive system amphidelphic and reflexed.

Types.—Holotype (Male)—NMNH No. 53543. Allotype (Female)—NMNH No. 53575. Paratypes: Males—NMNH Nos. 53542 and 53544 thru 53566. Females—NMNH Nos. 53567 thru 53574 and 53576 thru 53601. Juveniles—NMNH Nos. 53602 thru 53619.

Type-habitat.—Sediment contained within the foot cavity of the sea anemone *Actinauge longicornis* (Verrill, 1882).

Type-locality.—The benthos at 1,000 m depth off the coast of Uruguay near the mouth of the Rio de la Plata, 34°28′S, 51°40′W.

Distribution.—The localities from which *D. coptochilus* have been col-

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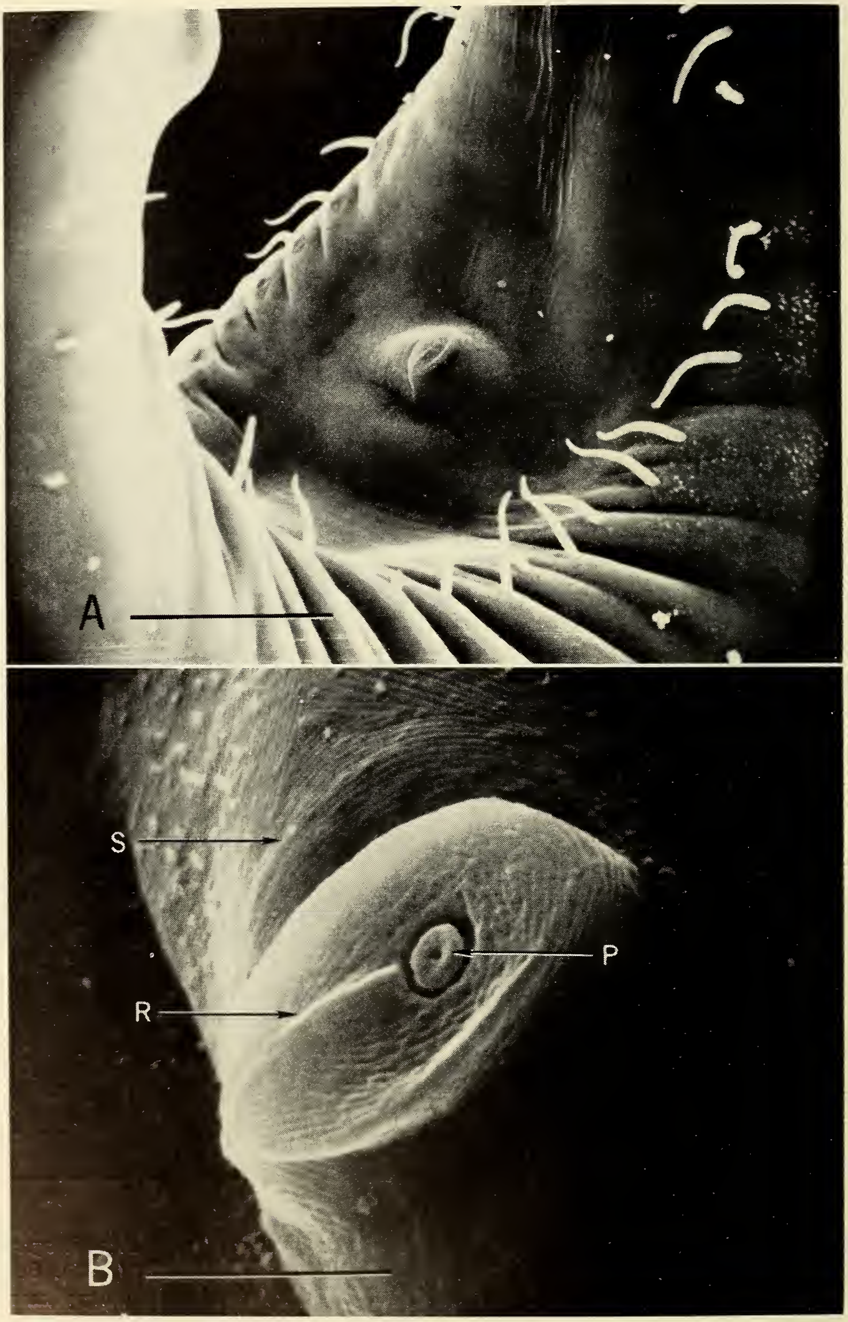
Fig. 5. Posterior ends of male *Deontostoma coptochilus*. A, Photomicrograph showing spiculum (SP), gubernaculum (G) and ventromedian supplement (VMS). Scale is 80 μm; B, Scanning electronmicrograph showing setiform subventral supplements (S), ventromedian supplement (VMS), and mammate evaginations bearing papillae (P). Scale is 50 μm.


A
S
P
R
B

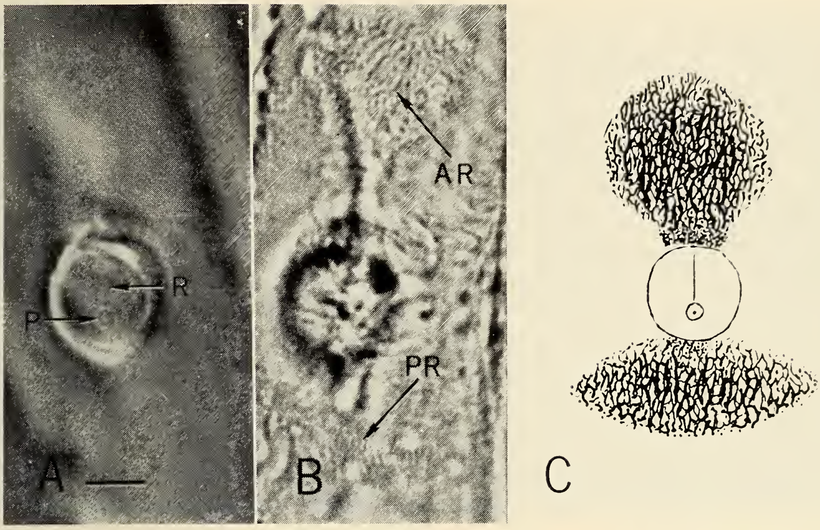


Fig. 7. Ventromedian supplement of *Deontostoma coptochilus*. A, Photomicrograph showing the peduncle (P) and ridge (R); B, Photomicrograph of the intra-cuticular reticulations anterior (AR) and posterior (PR) to the ventromedian supplement; C, Drawing of ventromedian supplement and reticulations. In all 3 cases anterior is uppermost. Scale applies to A–C and equals 5 μm.

lected, as well as the depth and numbers of individuals for each station are given in Table 2.

Etymology.—A combination of the Greek *copto*, meaning cut, and *cheilos* meaning lip, and referring to the division of each lip into 2 parts by the mandibular ridge.

Relationships.—The cephalic capsule in the genus *Deontostoma* is too similar between species to be a reliable diagnostic character when used alone. It is, however, an easy structure to observe and figure and, as a result, in some species it is the only structure for which useful data exists. Because of this, it currently provides one of the better known characters for recognizing groups of species within the genus, although these are not necessarily groups of common phylogenetic ancestry.

With this consideration in mind, *D. coptochilus* may be likened to the

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Fig. 6. Ventromedian supplement of *Deontostoma coptochilus*. A, SEM showing its position relative to the setiform subventral supplements, and its orientation. The posterior end of the animal is beyond the upper right. Scale is 30 μm; B, Details of the ventromedian supplement showing the peduncle (P) with its central pore, ridge (R) and field of surface striae (S). Scale is 5 μm.

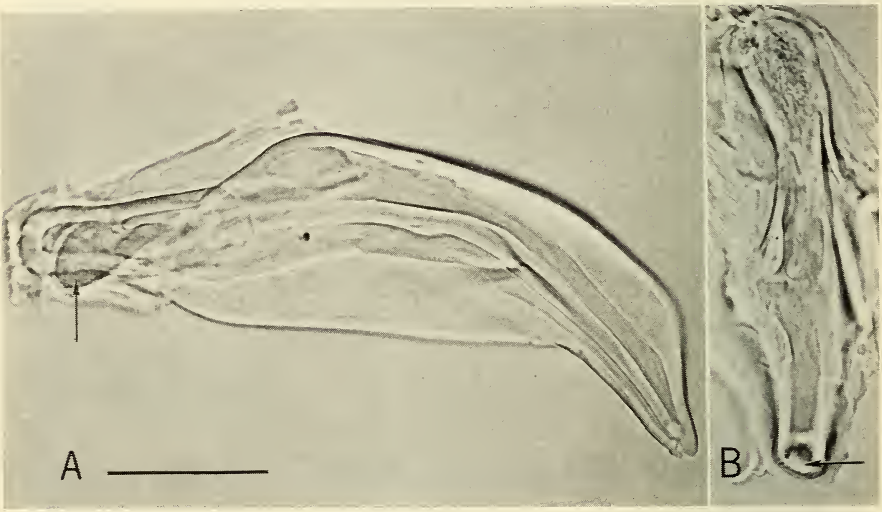

Fig. 8. Copulatory apparatus of *Deontostoma coptochilus*. A, Photomicrograph of left spiculum showing the lateral process (arrow) on the calomus; B, Photomicrograph of the left half of the gubernaculum showing the striae (arrow) at its distal end, and the absence of a crus. Scale applies to A and B and equals 40 μm.

following species in which the cephalic capsules have slightly rounded to truncate posterior lobes and/or no intralobar lacunae: *D. anchorilobatum* (Allgén, 1947), *D. demani* (Mawson, 1956), *D. elongatum* (Ditlevsen, 1926), *D. hopei* Coles, 1977, *D. karachiense* (Timm, 1959), *D. magnificum* (Timm, 1951), and *D. papillatum* (Linstow, 1903). While *D. anchorilobatum* is not known to have intralobular lacunae, it can be distinguished from *D. coptochilus* by the very rounded shape of the posterior lobes. Little else is known of this species since it was described from females and juveniles and the types apparently no longer exist. *D. demani* differs in that the dorsal lip bears "about six" small odontia, whereas it bears only 2 odontia in *D. coptochilus*. The lobes of the cephalic capsule of *D. elongatum* resemble those of *D. coptochilus* more closely than any of the above species. Unfortunately, data is incomplete regarding the structure of the stoma and male copulatory organs. However, the total body length (20 mm), distance between the anterior margin of the head and the eyespot (190 μm), length of the spicula (230 μm), distance between the cloacal vent and ventromedian supplement (216 μm) are substantially different from those of *D. coptochilus* (Table 1). *D. karachiense* is dissimilar by the striae at the distal end of the gubernaculum being on a thick lateral ridge, and by the presence of a well developed crus. *D. magnificum* differs by the presence of a well developed crus, the dorsal odontia are nearer the dorsolateral corners of the

Table 2. Collection data for *Deontostoma coptochilus* and the number of individuals of each sex and juveniles (θ) from each station.

Walter Herwig station numbers	Coordinates	Depth (m)	Number of specimens
422	35°40′S, 52°40′W	270	20♂ 25♀ 17θ
431	34°28′S, 51°40′W	1,000	5♂ 10♀ 1θ
68-1	34°36′S, 51°58′W	300	26♂ 22♀ 61θ
68-2	34°36′S, 51°58′W	300	13♂ 8♀ 66θ
34-60	35°43′S, 52°43′W	1,000	1♀ 5θ

mouth, and the mandibular ridges do not divide the microlabia. While little is known about the anatomy of *D. papillatum*, the length of males and females is given as 23.30 mm in the original description, and Filipjev (1916), in his study of the type-specimens, gave the length as 22.63 and 22.78 mm. Finally, *D. hopei* differs by the apparent absence of an onchium, rounder tail terminus, presence of a well developed crus, and its greater length (♂ = 22.50 mm; ♀♀ = 19.60–26.10 mm).

All other species of *Deontostoma* have prominent locules in the posterior lobes of the cephalic capsule.

Biological associations.—There are many accounts in the literature of free-living marine nematodes being associated in some way with marine organisms, either plants or animals. Most of the well documented cases are from ecological studies of the relationship between nematodes and the thalli of algae or blades of sea plants (Colman, 1940; Hopper & Meyers, 1966, 1967a, 1967b; Ott, 1967; and Wieser, 1951, 1952, 1954 and 1959), and/or between the nematodes and the rhizoid with its trapped sediment (Moore, 1971; Wieser, 1959). These studies have shown positive correlations between the algae and their associated nematodes and that each of certain kinds of nematodes may be peculiar to specific regions of the same algae, i.e. the tips of the thallus, the stems, or the rhizoid, etc.

Species of *Deontostoma* have not been found in any of the aforementioned ecological studies, although members of the closely related genus *Thoracostoma* have. On the other hand, species of *Deontostoma* have been reported in numerous faunal studies as associates of a diversity of organisms (Table 3). It is not known if there is a specific ecological relationship between any species of *Deontostoma* and its respective associate. However, the facts that species of this genus do occur in free sediment, and that at least some species, particularly *D. angustifissulatum* and *D. antarcticum*, have been found in association with such a diversity of organisms (assuming accurate identification of the nematodes), suggests that if an ecological association occurs, it is facultative at best.

Table 3. A list of the species of *Deontostoma* that have been found in association with other marine organisms. The name of the associates, its depth, location and reference are given for each ease.

Species	Assoeiate	Depth	Location	Reference
angustifissulatum	Algae	Washed ashore	Atlas Cove, Heard Island	Mawson, 1958
	Test of ascidian	163 m	67°46′S, 67°03′E	Mawson, 1956
	Lithothamnium holdfasts	210–217 m	67°38′S, 64°52′E	Mawson, 1956
anocellatum	*Macrocystis* holdfast	50 m	Morbihan Bay, Kerguelen Island	Stekhoven & Mawson, 1955
	Among algae	On beaeh	Jeanne d'Are, Kerguelen Island	Mawson, 1958
	Algae	Washed ashore	Atlas Cove, Heard Island	Mawson, 1958
antarcticum	Among algae attached to gastropods	—	Bay of Torrent, Londonderry Isle	DeMan, 1904
	Laminaria holdfasts	On beach	Morbihan Bay, Kerguelen Island	Stekhoven & Mawson, 1955
	Macrocystis	50 m	Morbihan Bay, Kerguelen Island	Stekhoven & Mawson, 1955
	Sponges	13–64 m	Graham Land	Inglis, 1958
	Algae	On beach	Jeanne d'Are, Kerguelen Island	Mawson, 1958
	Among seaweeds & green algae	—	Maequaire Island	Mawson, 1958
	Macrosystis formation	10 m	Falkland Islands	Allgen, 1959
	Algae & kelp rhizoids	Washed ashore	Falkland Islands	Allgen, 1959
arcticum	"In" *Lithothamnium murmanicum*	Littoral zone	Murman Coast	Saveljev, 1912
	Sand associated with *Fucus inflatus*	Littoral zone	Greater Aynov Island	Platonova, 1967
	Sand assoeiated with *Laminaria saccharina*	Littoral zone	Greater Zelenets Island	Platonova, 1967
	Stones with algae and Mytilidae	5–7 m	Islas Gueiteeas, Chile	Wieser, 1953
	Kelp from stones with algae and Mytilidae	0–1 m	Islas Gueiteeas, Chile	Wieser, 1953
	Sponges on small stones with algae	8 m	Canal Chacao, Bahia de Ancud, Chile	Wieser, 1953

Table 3. Continued.

Species	Associate	Depth	Location	Reference
	Holdfasts of big brown algae	Intertidal	Coquimbo Peninsula, Chile	Wieser, 1953
	Holdfasts of big brown algae	Intertidal	South of Iquique, Chile	Wieser, 1953
	Tufted green algae without detritus	130 cm below low tide level	Talcahuano-Golfo de Arauco areas, Chile	Wieser, 1953
	Durvillia holdfasts	Intertidal	Valparaiso-San Antonio areas	Wieser, 1953
aucklandiae	Old kelp rhizoids	—	South Georgia	Allgen, 1959
californicum	*Egregia laevigata* and *Laminaria digitata* holdfasts	Littoral zone	Dillon Beach, California	Croll and Maggenti, 1968
campbelli	*Macrocystis* holdfasts	50 m	Morbihan Bay, Kerguelen Island	Stekhoven & Mawson, 1955
karachiense	Rocks and algae	Littoral zone	Manora Island, Karachi, West Pakistan	Timm, 1959
lobatum	Algae	—	Barents Sea at Entrance to White Sea	Steiner, 1916
magnificum	Sediment under mussel beds	Littoral zone	Haystack Rock, Oregon	Murphy, 1965a (*T. pacifica* = *D. magnificum*)
montredonense	On rocks with *Bryopsis*	Littoral zone	Montredon, France	Marion, 1870
timmerchiorum	*Rosella antarctica antarctica*	57 m	Ross Island, Antarctica	Hope, 1974
washingtonense	*Egregia* holdfasts	Littoral zone	Dillon Beach & Pacific Grove, California	Hope, 1967
	Sediment from *Mytilus* bed	Littoral zone	Strait of Juan de Fuca, Washington	Murphy, 1965b

There are reasons why specimens of *Deontostoma* species might tend to occur in higher numerical density in sediments associated with sessile or semisessile organisms, if indeed such is the case. First, the host organism may, in a high energy, littoral environment, provide a stable habitat by trapping or holding sediment and detritus beneath it. Second, the host organism, be it plant or animal, and the various organisms it shelters, may secrete or excrete various organic compounds that serve as substrates upon which bacteria and other microorganisms may exist. These bacteria may, in turn, be the foundation of an entire food web, of which *Deontostoma* is a primary and/or secondary consumer. Third, it is possible that the host provides shelter from currents or predators. Protection from currents may be especially important in the littoral zone where many of the associations are known to occur. Nothing is known about the natural enemies of *Deontostoma* aside from the report of juvenile specimens of *D. antarcticum* having been recovered from the gut of a bottom feeding fish belonging to a species of *Zanchlorynchus* (Mawson, 1958). Indeed, the large size of the body of individuals of *Deontostoma* would make them more visible prey for fish than the smaller nematodes, should they emerge, even in part, from the sediment.

The apparent association between *D. coptochilus* n. sp. and *Actinauge longicornis* is unique in that it is the first report of a *Deontostoma* species in sediment from the foot cavity of a sea anemone, although, in view of the diversity of apparent associations in which specimens of *Deontostoma* are known to engage, this new account is not surprising. This is also the first report of such an association from the depths of a continental slope, the previous greatest depth having been 440 m (Vitiello, 1975).

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